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THE MAMMALS OF SOUTH CAMBRIDGESHIRE.

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I DESIGN in the following pages to describe what I have personally observed in the district south of the Fenland of Cambridgeshire—say, from Waterbeach in the north to Chesterford in the south—a large part of which is upland and more or less wooded, but includes such marshy spots as Fowlmere and Dernford Fen.

I confine myself at present entirely to the Vertebrata, and chiefly the Mammalia. Of the fishes, I shall say very little. In the district comprehended within a radius of fifteen miles round Cambridge I have spent most of my life, and when at home have been rambling about it almost daily, whenever I have not been confined to the house by accidents which have laid me low—not a frequent incident, I am thankful to say.

My observations go back to the sixties, and I cannot help but contrast the thickly inhabited Cambridge of the present day with what it was at the time when it was a garden city. Even in our place of business in the centre of the town we had a large garden on the east side of our house. But very little way from us, on the west side, was the old Physic Garden, the precursor of the present Botanic Gardens. On the south were the groves of Downing College, about the bird-life of which I have notes enough to make a volume. Even from the north there was an outlook over gardens and the 'Lion Hotel' bowling-green.

I have been in Downing Grounds from the time I could first toddle thither up to the closing of them to the public, and the

building over the parts where as a schoolboy I sought every nest, and studied the birds, aided in this by another boy whose adventurous spirit was unquenchable, and who "knew" every nest in Downing, or in the meadows bordering Tennis Court Road.

Even when not in the grounds, I was able to observe from the window of the uppermost room over our Dispensary, by the aid of a seaman's telescope, not only the Rooks building or repairing their nests, and feeding their young ones, but in winter the advent of any large, singular birds resting on trees. But I must check myself, or I shall get on to writing about the birds of Downing College, and this would make this article far too lengthy, for, as I have just said, I could write a volume about them.

While building Willoughby House, on the Mill Road, of which I was not only the architect but actually assisted in the practical work of erection, I had splendid opportunities for observing nature. Much of the work was done when the spring migrants were passing along the very tract, leading right across this part, which the birds pursued. When we had got the shell of the house up, and I was on the joists of the roof helping the carpenter nail on the slate-laths, I had a fir-tree close by my left hand, and this was one of a row of fir-trees to which the Siskins came.

Looking south-west I had an uninterrupted view across corn-fields right away to the Gég Magog Hills. More to the right the horizon was bounded by the trees in Brookland's Avenue, the best part of a mile away. Looking to the north-west the town, half a mile or so away, could hardly be seen for the bird-haunted trees in orchards and groves. Turning round, and looking eastward, I could see, when on the ridge of the roof, right to the tall poplar-trees near the old paper-mills across meadows and low-lying semi-marshy ground surrounding a long pool of water, which has been filled up and built on for years.

It was in the just mentioned corn-field that I was able to describe and sketch the method of the little Harvest Mice in building their wonderful nests, so cleverly tied to the corn-stalks by the little rodents. In our garden whereon we built my old house, Rabbits burrowed, and Weasels came after the Rabbits, although I have not seen one now about that part for over a quarter of a century. But I have seen them farther afield in the direction of Teversham and the Newmarket Road. A farm half



a mile or so beyond our house used to be known as Polecat Farm. When the growing town had begun to creep up Mill Road, I purchased a plot of ground much farther out in the country than Polecat Farm, and immediately on entering into possession had a lodge put up, which would, I thought, be convenient for observing wild life, and yet not be too far from Cambridge and my tutorial work. Although in a very few years the increasing human population drove away the Polecats and the Weasels, I was, by being in this lodge late at night and very early in the morning, able to make notes enough on the wild life of this part to fill a volume. The lodge was fitted up with a fireplace, so that I could have meals when I desired to make a late stay or came off without any breakfast, as would naturally be the case when I went very early in the morning.

Bats were abundant and so bold it was easy to catch them with a net made of cheese-cloth, and used like a butterfly-net. My object in capturing them was to make out a list of the species. They were mostly Pipistrelles, but there was an occasional Noctule. The last was plentiful about my residence and in the more immediate vicinity of the town. There have been Long-eared Bats also on one or two occasions, but *Plecotus auritus* has retired before the advancing town, and it is long since I have seen one about Cambridge.

I am one of those persons who can hear very high-pitched sounds such as those of Bats quite perfectly, while I am deaf to grave ones. I can discriminate the squeak of the Pipistrelle from that of the Noctule, and the tone of the Long-eared Bat is different from either. I have often amused myself by trying to make out the species by the sound of the "tweets" alone ere I verified my guess by capturing the Bat. I have heard Bats squealing in a tone different from those of any of the four most familiar to me, for often when strolling by the river-side I have been gladdened by the extremely high-pitched note of Daubenton's Bat.

While I am on the subject of Bat whistling I may mention that these little mammals have different tones to express the emotions excited by eager pursuit of an evasive moth, love, fear, and anger. They have their cries of alarm as different to their other tones as are the notes of birds under like circumstances,

and they have their love-tones when they are calling to and pursuing one another.

But I must defer to a future occasion all I have noted of the ways of the *Cheiroptera*, else I shall take up too much valuable space. When going round the hedgerows with a lantern it makes such a picture to come across a Hedgehog feeding on a fat worm he has tugged out of its burrow that I wish it were possible for me to get a snapshot of it with my camera. The comical surprise and bewilderment at the sudden flashing on to him of the bright light made a picture well worth preserving. Sometimes it may be a pair of Hedgehogs engaged in amorous play—possibly, by great good luck, they may have little ones with them. I must not include in this account of South Cambridgeshire wild life what I have seen in the lonely fenland, in the woods of the Breckland, and in the recesses of Epping Forest—all splendid places in which to observe wild life ; else I might say more about Hedgehogs and their family ways.

Another nocturnal animal my portable search-light reveals to me when out at night is the Shrew. Shrews were very common about the district I have just been describing. The Water-Shrew was then to be seen by daylight, even, early on a summer morning on the banks of the Stur rivulet. It still occurs, I believe, on the rivers Rhee and Granta.

In the days when our professional duties took us over to Orwell, Badgers were not at all infrequent over that way. There is much of the ancient wild life still persisting in that district, and I should be glad to see the County Council or Government establish a sort of miniature Yellowstone Park, and preserve this remnant from destruction. It is the only part of Cambridgeshire where I can assuredly say the Badger still breeds. When opportunity has offered I have regarded it as a pretty sight to see at early dawn a group of young Badgers and their parents returning to their burrow. The little ones are far less shy and suspicious than the old ones. I like, when observing wild life, to have a few tit-bits in my pocket or haversack. By patience and quiet movements I succeed in getting a near sight of creatures it would be impossible to observe effectively otherwise. Young Badgers, for instance, are very fond of dates, and a couple of pounds of these is a good investment if one wishes to make friends with them.

By the way, it is curious what a lot of animals love these sweet fruits. My Cat will beg for them, and eat as many as I like to give her. She is the kitten of one of those half-wild Cats whose progenitors were, I think, the extinct (so far as Cambridgeshire is concerned) *Felis catus*. Her mother was picked up on a country road, and had undoubtedly been born in a wood. These half-wild Cats with the stripes and short blunt tail, like *Felis catus*, are the sole representatives of the real Wild Cat now existing in this county. I have had them breed in the plot of ground I have mentioned, which is partly wooded, and one summer, while camping out on it, a kitten or two got on friendly terms with me, and came regularly to share my meals.

Although I have not for some few years seen the Marten in South Cambridgeshire, it was still to be numbered among the mammals in the days I am writing about. But it has always in my time been a scarce animal in this county, and my knowledge of its ways has had to be gained in other districts.

There was no necessity to be out very early in the morning in those days, or investigate at night with a portable search-light, in order to see the Stoats. These wild animals might be met with at any hour of the day. I have had one come and inspect me while eating my lunch by the side of a field, and move so leisurely it was easy to see it was neither a Weasel nor a Polecat.

My desire has been to see, by close observation, to what extent wild things vary individually in their ways and in different localities. I have long doubted whether the habits of any particular species are stereotyped to the descriptions of the standard text-books. Therefore, I have thought that first-hand notes on the natural history of a district such as that of South Cambridgeshire may have its value, even if it is not to be compared with wilder spots.

At the same time it is remarkable what a variety there was of wild life within walking distance of Cambridge a quarter of a century ago. The list of mammals observed by me, which I gave in the 'Garner' for 1886, included, besides the above-mentioned, a white variety of Mole, the Fox, Squirrel, a melanic variety of *Mus decumanus* (specifically different from *M. rattus*), the Common Long-tailed (*M. sylvaticus*) and Harvest-Mouse (*M.*

minutus), the Water-Vole (*Arvicola amphibius*), a piebald variety of the Field-Vole (*A. arvalis*), and the Bank-Vole (*A. glareolus*).

To the Shrews I add the Oared Shrew (*Neomys fodiens*), and the Little Shrew (*S. minutus*), which used to be called the "Irish Shrew (*S. hibernicus*)," but I cannot positively say I have seen the latter south of Waterbeach. The Oared Shrew I have not seen in South Cambridgeshire for some years. I am now specially engaged in looking out for it. My plan is to endeavour to trap these small mammals in traps similar to mouse-traps. For Water-Shrews a bait of fish is frequently irresistible; they are wonderfully fond of fish, and a piece perfectly fresh or a recently dead Stickleback will frequently entice them into the trap. The best time to set the trap is early in the evening; they are hungry when they first come out of their burrows, and sniff about eagerly after something eatable. If one has sharp eyes, and there is light enough to see, it is interesting to observe how carefully a Shrew quarters the ground in its search for food, going over every square foot of it. Now and again it will stop and nibble a bit of grass, for the Shrew seems to like a bit of greenstuff occasionally.

It may not be generally known that Otters attack and kill Water-Rats for food. Such is the case with those (few) I have observed on the Granta and the Rhee. If I were guided by my own personal observation of the South Cambridgeshire individuals, I should say that Otters do quite as much good by destroying Rats as they do harm by eating fish.

Foxes are more common in the south-east corner of the county. There they have increased so much that they are reported to be a serious menace to the Partridges, and some people cry out for their extermination.

I have hesitated to say more about the Fox than just mention it, for fear I may be led by my enthusiasm to launch out into a lengthy dissertation on this good old English sport, so exhilarating and healthy. I wish it was always conducted after the example of Sir Roger de Coverley, and the Fox be allowed to keep the life it has fairly fought for when it has made a good, game run.

We used to be over at Wimpole a good deal when the Fallow-Deer were there, and no one regrets more than I do that, except for one or two I seem to recollect being in the grounds of Peterhouse College some years ago, these graceful animals disappeared from the South Cambridgeshire fauna when the herd was sold.

SCIENTIFIC WORK IN THE SEA-FISHERIES.

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PART II.

SINCE the initiation of scientific work in connection with the fisheries at the beginning of 1884 very considerable advances, as already indicated, have been made in this country in various directions—especially in our knowledge of the development and life-histories of the sea-fishes themselves. Statistics, moreover, have shown how prosperous, on the whole, the fishing industry is,* and how, as the Royal Commission of 1866 had affirmed, there is still room for expansion.

In now reviewing the work accomplished by the scientific staff—especially that of the British section—into whose hands the International Fisheries Investigations were placed, it is scarcely necessary to explain that I fully appreciate all the difficulties of the task, as well as know the strenuous efforts to achieve noteworthy results. The subject, however, is of such importance to the country that perfect candour in dealing with the materials at hand (for the work is still unfinished) is indispensable.

GROSS TOTALS OF FISH LANDED IN SCOTLAND.

1897†.....	Cwt.	5,001,672	£1,627,752
1898	„	6,657,768	1,879,866
1899	„	5,145,076	2,189,933
1900	„	5,369,265	2,325,994
1901	„	6,385,170	2,238,310
1902	„	6,866,028	2,502,668
1903	„	6,518,808	2,410,287
1904	„	7,947,829	2,231,102
1905	„	7,856,310	2,649,148

* I had omitted to thank Professor Prince, Dominion Commissioner of Fisheries, Canada, for valuable information and statistics given in Part I.

† The last year embraced in the 'Resources of the Sea,' where all the previous years are reviewed.

In taking a brief survey, therefore, of the reasons which prompted our country to join the other nations in the investigation of the sea in 1902, it would appear that the main object was the prospective benefit to the British Fisheries, the scientific investigation of which had for eighteen years been actively carried out. It is also probable that the testing of the antagonistic views, *viz.*—on the one hand, of the 'Resources of the Sea,' and, on the other, of the 'Impoverishment of the Sea,' which is really a revival of the old doubts and fears—may have influenced the decision. It had, however, immediately been shown how untenable the notion, for instance, of Dr. Garstang was—that, because one hundred fishing-ships now catch what fifty did before, the sea is impoverished. Nature was thus expected to fill each square mile of the sea with fishes by measure, and send its quota mechanically into each ship. The diminished catch in each of the one hundred ships (supposing such did occur) would be more in accordance with reason. Even the sea, by the laws of nature, contains only a certain number of fishes at a given time, and it should not be a matter for surprise that there are fewer fishes, *e.g.* large flat-fishes, in an area after one hundred ships have swept it, than after the operations of ten using a similar method of capture. Yet it would be unsafe to speak strongly of such diminution. A change from trawls to fixed nets, or to bait, might upset the conclusions by the discovery of numerous fishes. As Mr. Archer and Dr. Kyle assert, the average catch per boat is insufficient to prove over-fishing.

The task, then, undertaken by the British naturalists was neither simple nor light, and there was no lack of courage in affirming that within the two years (for which the Government at first arranged) results would be forthcoming. A survey of the problem presented several lines of action, most of which had been laid before the Ichthyological Committee at the end of 1901. To the scientific investigator a careful and extended survey of the main grounds frequented by fishermen in the North Sea stands in the forefront, together with the distribution of the food-fishes in the more distant waters. If, for instance, the round-fishes stretched far outwards from our shores, anxiety for the near grounds would be removed. This survey would include the distribution of the eggs, larvæ, and young of the

fishes, their growth, and the changes at the different seasons, together with the appearance of anadromous fishes like the Salmon, at various stages, and would decide as to the present position of the British sea-fisheries in the North Sea.

Such a survey cannot be efficiently carried out by subordinates whilst the chief remains on land, since the experience gained under varying conditions gradually takes a definite shape after years of careful observation and inquiry at sea. Such experience is not gained by examining boxes of fishes on shore, by the tabulation of recorded observations, or the manipulation of sheets of figures filled up by others on board the experimental ships.

Another point, again, in these investigations is the effect of the operations of fishing-vessels in connection with variations in the abundance and in the size of the food-fishes. Such is a promising field for observation, but by no means international in character. It would include, for example, the effect of the work :—

- a. In temporarily diminishing the larger fishes, and rendering the smaller more conspicuous.
- b. In making the survivors more wary.
- c. In driving the shoals of pelagic forms from particular grounds, or otherwise.
- d. In demonstrating the effective nature of sudden changes in the method of capture—*e.g.* the substitution of Anemones for Mussels, of Cuttle-fishes for Herrings, of Lobworms for Scallops, and of the alternation of gill-nets with tempting bait of various kinds. Few appreciate the revelations made by such a change of method.

Other important points that suggest themselves to the investigator are the special study of hard grounds unsuitable for trawling, if any such exist in the North Sea.

The food of fishes and the pelagic fauna and flora are less in need of attention, since they already have been investigated sufficiently for all practical purposes.

Such are some of the problems that would have suggested themselves for solution on facing this inquiry.

It is difficult to ascertain precisely what the British investigators expected to discover, but the task of ascertaining “whether

the quantity and consumption of fish taken from the North Sea and neighbourhood are in proper proportion to the production occurring under the prevailing natural conditions, and whether any disproportion between production and consumption arises from a local over-fishing, or from an injudicious employment of the fishing apparatus at present in use," is one which, if it were possible, would have taken many workers to accomplish. However that may be, the observers also chose to include the systematic exploration of the small flat-fish grounds, an inquiry which would naturally fall under the first head already mentioned. It is evident that considerable ambiguity existed as to the nature of the task, since mention is made of the " publication of annual results," of " discoveries of practical importance to the fisheries," and of " recommendations for international action"—all excellent in their way, provided the field had been a *tabula rasa*—that is, that others had not previously searched the sea.

From the beginning of the arrangements for the international exploration of the sea one department placed itself in the front—*viz.* the hydrographical—and this probably was due to the influence of those associated with the origin of the scheme. No one will deny that, if hydrography could solve the complex problems which exist, or are supposed to exist, in connection with the ever-varying captures of sea-fishes, with their distribution, and their daily or seasonal movements, a great gain to our knowledge would result; but a perusal of the publications of the International Council up to date shows that this is yet far distant, no reference, indeed, to fisheries' problems occurring in some of these long reports.

Those of us who have watched the hydrographical efforts since 1872—when the German ship 'Pommerania' included these in her work in the North Sea; who have endeavoured, on the spot, to connect temperatures of the sea at surface and bottom with the captures of fishes; who have studied those of the Scotch Board in the eastern and western waters of North Britain; and who have personally been interested in the Scotch Board's international survey of the North Sea, in conjunction with the Swedish, German, Norwegian, and Danish Governments in 1893-94, have, however, reason to maintain reserve on this head in connection with the sea-fisheries. The consideration

of the results of these surveys, indeed, does not lead us to expect a solution of fisheries' problems from the hydrographers, however much we may appreciate their skilful and patient, though expensive, labours in other respects. Therefore, grave doubt was expressed, in 1901 and 1902, as to the propriety—at least, so far as Britain was concerned—of making such observations so prominent in the international scheme.

The International Council has published four bulky quarto Bulletins annually, besides other papers, giving hydrographic details, temperatures, and tables of floating organisms. Few important additions have been made to the latter—except the long list of species of diatoms—since the subject was dealt with for a whole year in St. Andrews Bay in 1888. The hydrographical remarks merit careful attention, since the British naturalists—from the experience acquired in these investigations—state that they are within measurable distance of explaining all the migrations of the fishes, as well as the fluctuations in the fisheries, by such means. Further, that ordinary trawling experiments are of little value, unless hydrographical, physical, and chemical researches go with them; that the changes in the water cause the changes in the fishes which (species not mentioned) may be in one place in autumn and another in spring; in short, here to-day and away to-morrow to their special waters. They narrate that, though the periodic Gulf Stream does not reach the North Sea, yet Atlantic flooding into this area occurs at the same time. There are, however, perturbations, the study of which belongs to the future. Dr. Otto Pettersson, indeed, thinks these disturbances show a two-yearly period—even and odd years—the even with more temperate waters than the odd, and accompanied by a warm-water area in the cold season—with a failure in fishing. He adds that the winter Herring-fishery in the Skagerak has returned with intervals, on the whole, of 111 years—since 859. Other hydrographic researches—such as that of the Faroe-Shetland Channel and the Influence of the East Icelandic Polar Stream on the climatic changes of the Faroe Isles, the Shetlands, and the North of Scotland—do not seem to bear on the main point at issue, and the same may be said of another on the compressibility of sea-water.

So far as experience goes, it is scarcely possible to explain

the changes in the fish-fauna on these grounds. The movements of the Herring are independent of such phenomena, and we now know that the Herring abounds all the year round, and can be captured—irrespective of currents and temperatures—in considerable numbers at any time. Moreover, hydrographical influences are powerless to cause it to deviate in its progress to the coast to spawn. The sudden disappearance of the Herring from its wonted spawning grounds is not due to hydrographic influences, any more than to the guns of the artillery volunteers, as the fishermen supposed. Dr. H. M. Kyle, a trained marine zoologist, plainly says that neither the temperature-charts nor those for salinity exhibit a true parallelism with the biological phenomena, and suggests weekly instead of monthly data. Some, however, may be of opinion that even hourly records would be equally futile. It would almost seem to be as reasonable to explain the passage of the larvæ of animals dwelling on the bottom to the surface of the sea by similar data.

It is well known that in a shallow bay a cold frosty morning is bad for fishing, that extreme cold kills fishes and their eggs, and that the high temperature of summer favours swarms of fish-food, which, however, equally abounds in the arctic seas. Fishes, moreover, are not so sensitive to changes of temperature, to changes in salinity, or to other phenomena, as supposed ; neither do they dread currents. The Salmon, the Sturgeon, and the Eel are at home both in the sea and fresh water, and the Flounder, the Mullet, the Sea-Perch, the Sprat, and the Sparling take little notice of varying salinities. The Baltic Herring can readily be acclimatized to fresh water, even to the extent of being killed, if by accident it suddenly falls into sea-water. The Shanny from the rock-pools is indifferent to immersion in fresh water. Even the transparent floating eggs of the Flounder may be heated in a test-tube till they rush up and down with the currents, and yet may be safely hatched subsequently. Further, irrespective of temperature and currents, the very young fishes invariably follow the laws which regulate their appearance at particular seasons. Thus the young Cod, Green-Cod, Haddock, and Whiting, after their earliest (larval) stage, are oblivious of currents in their movements—on the one hand to shallow, and on the other to deep water, and the same may

be said of the young of the flat-fishes. There is no reason to believe that the hardy adults are affected by temperatures, currents, or salinity in a greater degree, except in so far as storms may sweep into bays greater quantities of food; or a fish, to which cold water is congenial, may approach the coast more closely in winter, or follow the pelagic organisms characteristic of the season.

It would thus be only reasonable and just to say—with Dr. Otto Pettersson—after all the complication and expenditure on this head in relation to the influences of such phenomena on the fisheries: “The full answer, which practically is of vital importance, will not be at hand for years yet to come.” The great expenditure for hydrography in these investigations was not entered on without warning, and it is noteworthy that the Hydrographic Report by Dr. Pettersson was not adopted by its section, but was printed only as the private view of the author.

We now turn to the publications of the senior naturalists whose efforts were to be directed to the special elucidation of fisheries’ problems, such as the present condition of the food-fishes of the North Sea, and who were, moreover, to make the “announcement of those discoveries which are of direct practical importance to the fishing industry,” as well as furnish “recommendations for international action.”

Commencing with the southern section, the first subject to be dealt with is the fisheries’ work of the Marine Biological Association, a body which more or less identified itself with the “Impoverishment of the Sea.” From its workers, therefore, with their new and unequalled opportunities, we looked for substantial proof of the soundness of their position, more especially when it is stated that “facts have been obtained upon which a proper understanding of the yield of the sea must in future be based”—a pregnant sentence, which apparently dispenses with all previous observations at home and abroad.

This statement appears to derive its origin, not from laborious surveys of the fish-fauna of the southern half of the North Sea—both practically and scientifically studied in the adult and young conditions—but from certain experiments with marked Plaice. The marking of Plaice has long been carried out by the Fishery Board in Scotland without important results, whilst the Americans

have dealt with Cod. The Germans and the Dutch, again, joined in marking Plaice in the international work. The Plymouth naturalists, then, labelled a number of Plaice, returned them to the sea, and founded on the numbers of those subsequently captured several important conclusions, *viz.* (1) the migrations of the species, (2) the rate of growth, and (3) the intensity of fishing.

In regard to the first head, *viz.*—the migrations—one Plaice travelled 175 miles and another 210 miles in three months, and Dr. Garstang considered that there was a general tendency to move from the small fish-grounds of Holland to deeper water in summer, and of those in the southern bight of the North Sea to move northwards. Of those below $9\frac{1}{2}$ in. most remained on the spot in winter, migrating offshore in a north-westerly direction the following summer; whereas fishes exceeding that size migrated southwards and westwards shortly after liberation. Dr. Bolau, the German experimenter, differs from Dr. Garstang, the former stating that Plaice leave the coasts in summer and autumn, and return in spring, whereas the latter gives spring and summer as the period for migration to the offshore. Here, then, is considerable variation in the results, and neither agrees with the condition at St. Andrews. Moreover, it may be that the irritation of the label may have had something to do both with the capture and the migration of some of the marked Plaice, for the wound made by the transfixing wire is often irritable, is in contact with bone, and may be felt by the fish when skimming over or into the surface of the sand. Besides, some of the captured fishes were not well-nourished. If the white surface of the flat-fishes could be tattooed, such would be a great improvement on the present rough method, which even in the hands of a skilful operator leaves a source of constant irritation, and a permanent lesion. I have no doubt that Sir James Dewar could readily suggest an indelible and comparatively innocuous colour for this purpose.* The migrations of these marked Plaice and other forms, however, are interesting in connection with the distribution of the species and their general safety. The data are as yet too few, as Dr.

* Sir James recommends the carbonaceous or Indian ink process. Experiments will shortly be carried out at St. Andrews. An instrument with numerous points would probably carry out the work quickly.

Heincke states, and the time too short for reliable observations ; and the same may be said of Dr. Fulton's notion that the Plaice go against the current to compensate for the drift of their eggs. On the whole, it is doubtful if more can be proved than that the very young Plaice seek the tidal margin, and, as growth advances, gradually pass to deeper water, and that in this, as in other flat-fishes, considerable distances may be traversed. Their vigour and vitality, in any case, would enable them to sustain a long journey (*e. g.* to Australia).

The second head—*viz.* the rate of growth—has long been studied, and the additional information gained in these investigations bears, as in Johansen's observations, more on the proportional rate of growth in connection with locality. It was found, for instance, that small Plaice taken from the Horn-reef and liberated on the Dogger-shoal grew about five inches in seven months, the transplanted Plaice thus showing an increase of four times in length and six times in weight over those left on the reef. A. C. Johansen's figures are—young Plaice on beach grew 2-3 cm., those on Horn-reef 4-5 cm.; those on the Skagerak, 10 cm. The latter is thus even more favourable than the Dogger-shoal.

It is accordingly suggested by Dr. Garstang that small Plaice should be transplanted from the crowded inshore to the offshore grounds, such as the Dogger. The Danes, indeed, have done so for some years in the Lim Fjord, a sandy, land-locked lagoon formed by the breaking in of the sea about one hundred years ago, the young Plaice thus finding an entrance, growing in the lagoon, and forming a fishery. Their numbers can readily be augmented by artificial transplantation (for the fishermen do so at the rate of about two for a farthing), whilst they are tolerably safe from escape to the sea, which is forty miles distant. This, however, as an acute critic* has already pointed out, is a different condition from an open seaboard like our own, where the Plaice are free to pass outwards as they grow older, and best know where to find suitable feeding-grounds. In this connection no difficulty was experienced twelve or thirteen years ago in transplanting hundreds of Soles from Scarborough to St. Andrews Bay ; but this would be a somewhat expensive method of increasing the yield of the sea, even were it necessary. The life-

* 'Fish Trades Gazette.'

history of the Plaice does not seem to suggest it. It is possible, from the observations of Dr. Wallace on the ear-bones and other points in this fish, that its average rate of growth is higher in offshore than in inshore grounds. Experience would seem to show that there is little fear of suitable ground being left unoccupied by such fishes as Plaice.

The third head—*viz.* the intensity of trawling in the North Sea—as indicated by the capture of the marked Plaice, is apparently considered an important discovery by the staff of the Marine Biological Association. In all about 900 marked Plaice were liberated in the offshore and about 563 in the inshore grounds, the percentage captured in the former being twenty and in the latter ten in twelve months, it being explained that fewer captures take place in the inshore grounds when trawling is prohibited. The Association, therefore, considers that “from this result it seems clear that the total annual catch of the fishermen no longer forms an insignificant proportion of the total stock of Plaice.” In short, fishing would thus appear no longer to be an uncertain pursuit in the hands of the Association.

But, as pointed out in the first lecture, this conclusion is not supported by fifty years' scientific experience of the Bay of St. Andrews, a bay which contains no spawning Plaice, which are in the open waters beyond, free to every trawler, nor does it appear to coincide with the history of the Plaice-fishery of the Cattegat. Again, in the old trawling days of nearly a quarter of a century ago, it was not uncommon to bring on board the dead Frog-fishes (usually with a slit on the under surface), and old utensils of other trawling-ships on well-known grounds, and, though this showed considerable intensity of fishing, yet the same grounds are regularly fished to-day in their season. There are various degrees of intensity of fishing ; thus, though Salmon, Green-Cod, Greenbones, and other forms occasionally abound off our shores, yet they seldom appear in the trawl. As already shown, fixed gill-nets for Cod and Plaice make us acquainted with various forms (Sharks, Porpoises, Sturgeons) rarely met with in the trawl or on the lines.

Besides, the numbers dealt with are too few for a conclusion so important, and there is considerable difference of opinion amongst the international observers themselves. It would seem

that the Dutch caught the largest proportion of marked fishes (but it was said that they liberated them on their own coast where a most active fishery goes on), the English following, whilst the Germans caught least.

Bearing in mind, therefore, that many of the Plaice so marked may have been restless, indisposed to seek shelter in the surface of the sand, and less active in avoiding the trawl, though continuing to grow, it would appear that, whilst full credit is awarded to the observers, caution is necessary in accepting these data as proofs of the serious intensity of fishing in the North Sea and the Channel.

The work in the northern section of the North Sea may now be referred to. It was hoped that the extended experience of the Fishery Board for Scotland would have produced during these five years a store of substantial information drawn directly from the fishing-grounds in their new ship. Personal contact with the varied phases of the capture of sea-fishes, with their surroundings, and with their distribution, are indispensable for an accurate grasp of the subject. Further, the consideration of their movements, whether for food or otherwise, and still more of their development and life-histories, as bearing on the practical problems to be solved, afford an ample field even for the most unflagging investigator. It may have been the prospect of these opportunities that caused the scientific representative of the Scottish Board (Prof. D'Arcy Thompson) to guarantee results in so brief a period as two years.

On turning to the large 'Blue Book,' published at the end of 1905, with an interest intensified by the experience of the excellent original work, which for so long a period has characterized the Board's scientific staff, surprise was felt on finding that about three-fourths of it consisted of hydrographical work (part of which has already been published elsewhere), of a record of pelagic fauna and flora, and of a review of eighteen years' commercial statistics collected by the Granton Steam Fishing Company, by Messrs. Johnston, of Montrose, and by the Board's officials at Aberdeen, the latter arranged according to the scheme*

* Squares of one degree of latitude and two of longitude. Prof. D'Arcy Thompson says two degrees in latitude and one in longitude. Dr. Fulton arranged for these squares by taking every degree of latitude and every second degree of longitude (see his paper).

of the Board's scientific superintendent, Dr. Fulton, who contributes the final paper in the 'Blue Book,' *viz.* "The Distribution and Seasonal Abundance of Flat-fishes in the North Sea." A second Report of a purely hydrographical nature has just appeared, as if to emphasize the surprise in connection with the first.

Science, as well as the country at large, had anxiously looked forward to a new and original series of fisheries' investigations in the North Sea, based on a well-considered plan, and carried out by the most skilful and experienced zoologists trained to fisheries' work, and aided by all the scientific accessories of modern times. Pioneer's work in this department is a thing of the past, and random efforts are wasteful as well as inopportune. The importance, indeed, of having zoologists trained to fisheries' work on board the experimental ships was duly emphasized in the case of the 'Garland,'* in which those on board simply filled in blank forms, which were transmitted to the central office—far from the field of operations—and where the compiler was out of touch with nature. Unfortunately there is little evidence of the scientific methods just mentioned in this ponderous 'Blue Book.' If such experiments have been efficiently done in connection with the international work, they are still, at the end of five years, in obscurity.

So far as can be gathered from these statistics, fishing rises to a maximum in August, and falls to a minimum in December, a feature shown a considerable time ago both in the pelagic fauna of the Bay of St. Andrews and in the work of the 'Garland.' Many random observations on the maxima and minima of the food-fishes occur, such as that the Haddocks increase as temperature rises, and begin to abate as temperature falls, and that they show in recent years an inferior yield to the earlier ones. The Whiting reached its highest curve in 1901 (winter), and its abundance was generally converse of the Haddock. It is unnecessary to deal more minutely with these remarks, which, though interesting, have no real bearing on the present inquiry. Even less can be deduced from the Montrose statistics, except that they indicate a persistent rise to the present time.

The opportunities afforded by the great captures of food-

* The Scotch Fishery Board's first ship for scientific investigations.

fishes landed at Aberdeen do not appear, mathematically treated,* or otherwise, to have produced results of moment, though elaborate curves are given of the increase or decrease of particular fishes in each of Fulton's squares in the northern part of the North Sea.† We are told, however, "that by these methods, if we only had statistics enough, we should mark down accurately for each fish the time of the coming at every position in the North Sea, and then, weaving all the facts together, show the route followed in the migration of any species"—amongst which the Wolf-fish or Cat-fish seems to be included. While a tribute may be paid to this enthusiasm, it must be confessed that not even the use of a Brunsviga calculating machine for the averages impresses the reader of the importance, in view of the practical question demanding solution, of all these pages of curves and tables. One feature nevertheless is apparent, *viz.* that the fisheries of the North Sea, including the grounds long fished and near the Scottish shores, are in a sound condition, a conclusion, however, arrived at long before these international investigations commenced. Perhaps one of the most interesting contributions in this 'Blue Book' is the series of monthly maps showing the position of liners and trawlers throughout the year. From these charts alone evidence of the wide distribution of the food-fishes on the old grounds as well as on the new is unmistakable. They constitute, indeed, an answer in facts to certain aspects of the impoverishment theory.

The Scotch Board's further contribution on "The Distribution and Seasonal Abundance of Flat-fishes in the North Sea," by Dr. Fulton, is also largely a statistical paper—from the author's position at the great fishing centre of Aberdeen. Though it omits many previous observations, it would be improved by condensation, especially as Dr. Henking's work on the fishes of the North Sea and the Cattegat, and Dr. Heincke's, overlap it so far as the flat-fishes are concerned.

One of the main points in this paper is what is called complementary and compensatory fluctuations in these statistics, *viz.*—one form taking the place of another, *e.g.* the "Whitch" in square xiv, near the Fair Isle, during winter taking the place of

* Mathematical theory of probabilities.

† The reporter thinks Witches or Pole-dabs recent fishes in the market. This is scarcely correct.

Dabs, Plaice, and Lemon Dabs. There is, however, an element of uncertainty in these fluctuations, which are well known to fishermen considerably nearer home. The author, indeed, mentions that Henking, who had found similar fluctuations, is of opinion that Plaice are caught in greatest abundance in winter. At St. Andrews such has generally been the case, *viz.* in late autumn and winter, whilst Dabs are mostly caught in summer and Flukes in early spring. At any rate, the working season of the fishermen at a particular fishing has to be considered, and it would have been more satisfactory, as in 1884, to have had the captures made under the observer's eye, and with all the circumstances before him. Consequently, it is doubtful how much weight can be put on the assertion: "I believe that the discovery of this principle or law of compensatory fluctuations, as described in this paper, will materially assist in the explanation of many points in the natural history of the food-fishes that are at present obscure."

It is further stated that the maxima of the captures in each fish correspond to the spawning season, but that some have two maxima and minima, the cones and curves of his illustrative diagrams thus being complex, and the cones of the immature may be in unison with those of the mature. No explanation, however, is given of a remark that the "Witch" has a high cone in winter and a small secondary cone in the warmer season marking the spawning period. The same criticism applies to some of the cones of the Plaice, neither corresponding to the spawning season; indeed, it is doubtful if much importance can at present be attached to some of these cones. The author is of opinion that congregation on the grounds and subsequent dispersal, or migration from one area to another, will explain his curves, but as no steps were taken to ascertain their presence or absence by other methods, this is conjectural. Moreover, he observes that the scarcity of flat-fishes in the deeper water in winter is due to their withdrawal to the coast, and hints that the Moray Firth may be one of these areas of refuge. But St. Andrews Bay and the region beyond are coastal areas, and no support can be found there for such a view. A doubtful statement, again, is that Dabs do not penetrate to the deeper water at any period of the year. If by deeper water twenty to forty

fathoms is meant, that is just what Dabs do, and the young may be reared there—in marked contrast to the Plaice, as was pointed out in 1884. Turbot and Brill extend over the greater part of the North Sea, yet the Turbot is at its minimum in his squares at the spawning season. Its wide distribution is probably a guarantee for its safety.

Taken all in all this contribution is of a different type from the preceding papers of the Scotch Board in this 'Blue Book.' It is true most of the points of importance in regard to the flat-fishes were previously known, and it would sometimes appear that the check of actual work in the sea itself, and close contact with the fishermen, lead to misinterpretations. While interesting, moreover, it does not deal directly with the great question handed over to the Scotch Board to solve, but it furnishes support to the views in the 'Resources of the Sea,' since it shows that the total average of pounds per hour of fishing was:—

In 1901	....	....	....	....	....	21.2 lb.
1903	....	....	....	....	....	21.7 lb.

Of the other fisheries papers which the International Investigations have produced few are of greater interest than an elaborate contribution by Dr. H. M. Kyle, "On the Statistics of the Sea-Fisheries in the Countries of Northern Europe." Briefly, these show that there is no decrease in the total quantities over this very wide field, though it is possible the average size of certain adults may be reduced, yet the intermediate stages of the Plaice and the Haddock have increased. He finds the total quantities of fish of all kinds landed in the North Sea ports in 1000 kilos. (1 cwt.=50.8 kilos., 1 ton = 1000 kilos. about) are:—

For 1902	....	....	....	....	....	575,255.
1903	....	....	....	....	....	940,739.

Of these totals about fifty per cent. arises from the Herring fisheries.

Again, the much vexed Plaice-fishery of the North Sea produced, in 1902, 43,339,000 kilograms (1 kilo.=2.2 lb.), whereas in 1903 it was 83,958,000 kilos., but from the latter a deduction for Plaice brought from other grounds brings the total to 45,000,000 kilos.—still considerably above that of the previous year. Dr. Kyle points out that the intensity of fishing in the offshore grounds is but a fraction of what it is in the inshore

grounds. Moreover, he demonstrates that Dr. Petersen, an able Danish fisheries' investigator, made an error in asserting that the Plaice-fishery of the Cattegat, which was begun in 1876, had reached its maximum, and was in 1894 declining. Dr. Petersen, however, believes—it may be with reason—that overfishing may occur when the numbers of fishes are stationary, or even increasing, a condition which perhaps, in the face of facts, might not be inappropriate for the scientific men in our country who uphold the impoverishment of the sea. Dr. Kyle, then, found in 1904—ten years after Dr. Petersen's report—that not only was the Danish Plaice-fishery as productive, but even more so, a larger number of boats being employed; and, as if to show the resources of nature, a new Plaice-fishery by the Swedes along the northern border of the same area had sprung up (since Dr. Petersen's report), and was flourishing. In this interesting contribution by Dr. Kyle many facts of importance are brought out. Thus, for instance, the quantities of Cod taken by Norway alone are three times those of all the other countries round the North Sea combined. He points out, moreover, the well-known fact that trawls only fish on the bottom, and thus are unable to give a complete account of the distribution of fishes, even on open grounds. The conclusions of Dr. Kyle are substantiated by an account, by A. C. Johansen, of the biology of the Plaice for Denmark, for he shows that as soon as the Plaice-seine was adopted by the fishermen (1872-80) the fishery grew apace. Thus the total yield of the Danish Plaice-fishery was:—

1887	....	....	....	....	....	1,048,000	kroner.
1903	....	....	....	....	....	3,017,000	,

The author is of opinion that the whole conditions in the North Sea are favourable, for with the increase of material there is a steady increase in yield.

Another paper of unusual interest is that containing an account of Dr. Hjort's work in the Norwegian sea. Many of the results were known, however, before the International Investigations began. He found three fish-faunas in these northern waters, *viz.* an arctic fish-fauna on the northern side of the ridge, from the Shetland-Faroë channel to Spitzbergen; an Atlantic fish-fauna on the southern slope of the great submarine ridge (in the deep basin of the Atlantic); whilst a third, allied to

the coastal fauna, occurred on the ridge itself. But what most concerns us is his discovery of vast multitudes of young fishes of the Cod tribe from Jan Meyen southwards—enough, and more than enough, to supply all the needs of the North Sea. With such enormous resources at command Nature is able to cope with ever-increasing captures.

Space would fail if allusion were made to all the scientific (zoological) fisheries' papers, but some are so important on general grounds that they should be briefly mentioned. Thus Dr. Fulton found Cod, brought from grounds one hundred and eighty to one hundred and ninety miles north-east of Aberdeen, were spawning in autumn—another fact which increases the safety of the Cod. Joh. Schmidt gives important information on the young stages of the Cod tribe, of the Lings, Halibut, long rough Dab, and Torsk. Dr. Kyle produces two papers for the use of International workers, *viz.* "On the Literature of the Ten Principal Food-fishes of the North Sea," and a "Catalogue of the Fishes of Northern Europe." Dr. Wallace contributes an able paper on the ear-bones of the Plaice in connection with age and rate of growth. A. S. Jensen (Norway) writes on the ear-bones of fishes from the bottom of the deep polar sea, and shows that Cod may frequent the upper layers of the water and be overlooked. A. C. Johansen describes the life-history of the post-larval Eel. Dr. C. G. J. Petersen (Denmark) contributes papers on the larval stage of the Ling, the larval and post-larval stages of flat-fishes, on the larval Eels of the Atlantic coast, and on the fisheries of the Cattegat and Sweden. Schmidt and Petersen give an important account of the spawning-ground of the Eel.

On the whole, those papers on the larval and post-larval stages of the food-fishes do not, with a few exceptions (*e.g.* Schmidt and Petersen on the spawning-place of the Eel), show much that is strikingly novel, for they had long before been worked out from the egg to a recognizable stage at St. Andrews.

Of zoological papers more suited for the work at marine laboratories, and the expense of which was unnecessary, are those on "Crustacea Collected during the Hydrographic Cruises," "New Crustacea," "On Copepods," and on "A Siphonophore (*Muggiaea atlantica*)."

Besides, it is not necessary, so far as Britain is concerned, to absorb time and money in the present special investigation on the food of fishes. That has long been sufficiently known for all practical purposes. Neither would the great labour and cost bestowed on the temporary and permanent pelagic or floating organisms seem to be warranted. Enough has long been known to demonstrate the ever-abundant supplies from diatoms to fishes. Concentration in an inquiry of this kind is essential.

In conclusion, therefore, a survey of the published work of the International Fisheries' Investigations, excepting that of the Bureau, from the British standpoint, has failed to elicit a satisfactory answer to the fundamental question submitted to the British investigators, *viz.* "Whether the fishes in the North Sea are," to state briefly, "in proportion to their consumption, and whether any disproportion between production and consumption arises from an injudicious employment of present apparatus."

Though some zoologists, apparently less confident of solving the various problems in their own department, pin their faith to hydrography, this science is, to make a slight alteration on the words of its workers, still at an immeasurable distance from being helpful; whilst it has—formerly and now—entailed heavy expense.

The results in the southern section of the North Sea—as to migrations, rate of growth, and the intensity of fishing—though interesting, are premature and inconclusive, and the distribution of the Sole has not been forthcoming; whilst those in the northern section, on the whole, and though some are laborious, make little real advance on previous knowledge, yet they inadvertently support the view of the 'Resources of the Sea.' Neither substantiates the theory of the "Impoverishment of the Sea," and both leave much of the British area unexplored.

On the other hand, in the light of long experience, a general consideration of all the facts of the British and Continental workers is fairly compatible with the safety of the fishes in the North Sea.

The experience of this costly international work, however, shows that, with the exception of the Bureau, it is not well adapted for any practical gain to the British Fisheries, which are best managed by central boards and a carefully trained

scientific staff. Scotland and Ireland, to some extent, already have these ; England has not, and Lord Dalhousie's recommendation has additional force to-day.

An endeavour has been made in these memoirs to show that, on scientific grounds, the British Fisheries are not unsatisfactory, and that Nature is capable, by her marvellous resources in the sea, of keeping pace, even with all the modern agencies of destruction. Yet no supine attitude is advocated. Constant care and vigilance are becoming, under this great national trust of the sea-fisheries, and of the hardy race so largely dependent on them. The liner should be encouraged to adopt gill-nets in suitable inshore water, and also to vary his methods of fishing with bait. He has still, in the Herrings alone, about half the totals landed from the North Sea, besides Pilchards, Mackerel, Sprats, Lobsters, Crabs, Shrimps, and shell-fishes, not to allude to a share in the white-fishing, and the undisputed freedom of all the closed waters. In his case industry and sobriety never fail to afford a competence.

It is, indeed, fortunate for this and other nations that the unbroken chain of circumstances combines to render the sea-fishes so capable of holding their own, not only in former geological periods when, for instance, the gigantic fish-eating *Ichthyosauri* traversed the seas from pole to pole, but to-day. For what alternatives are before us ?

Artificial hatching, while admirable in fresh-water and anadromous fishes, has not yet been proved (and this is said with all deference to the splendid efforts of the Americans) to be of actual service in marine fishes, the young of which are everywhere so numerous. Besides, the heavy expenditure would ill be borne by the taxpayers when the foreign fishermen share equally with their own.

Transplantation could readily be carried out, especially with flat-fishes, though under the same international disadvantages ; yet Nature in our open waters needs but little aid in this respect.

More might be said in favour of a size-limit, but that more has much of sentiment in it ; for, whilst the ordinary fisherman dare not sell his small fishes, and could not possibly eat them, many—indeed, almost all those hooked—would perish. But what would the Legislature make of the destructive shrimper who

cares neither to sell nor eat the small fishes ? Moreover, it is hollow legislation which imposes a penalty in the case of small flat-fishes, and is purblind to the slaughter of young round-fishes.

The closure of large areas of the sea rests on no scientific basis, and there cannot be a doubt that the public are thus deprived of a large and perennial supply of fishes of easy capture.

To him who revives the barren fears and doubts of many centuries, and to the disciple of the "Impoverishment of the Sea," there is thus little to choose in the round of alternatives.

On the other hand, the plenitude and the endurance of the sea-fishes are marvellous, yet true. Nature is even prodigal in their vast abundance and variety. Indeed, it is by no means certain whether the combined destruction caused by invertebrate marine animals, from the democratic Jelly-fish (*Cydippe*) to the predatory Cuttle-fish, by the food-fishes themselves, many eating their smaller brethren or the young of their neighbours—even the Herring swallowing dozens of the floating eggs of the white fishes with its food—by predatory fishes like Sharks, Dog-fishes, and Skate, by the vast army of piscivorous birds, by the multitude of Whales, single and social, and by the Seals—I repeat, it is by no means certain whether this combined destruction does not equal, if not exceed, in numbers at least, that of man himself. Let us, then, be chary of futile international or other expenditure in search of a phantom, but at once organize the scientific staff of the three centres of the kingdom on a modern (which means a separate, *i. e.* apart from agriculture), effective, yet not costly footing. Finally, whilst vigilant in guarding the great national trust, and in checking any avoidable waste of fish-life, let every well-conducted method of capturing the sea-fishes be free from unnecessary restrictions.

OBSERVATIONS OF AN ATTEMPT OF THE SWALLOW
TRIBE TO WINTER IN SOUTH HANTS DURING
1906-7.

By HARRY BEESTON.

(Continued from p. 234.)

Dec. 22nd to 24th.—Neither Swallow nor Martins seen.

25th.—Cold N.W. wind. It is not often that birds of the Swallow tribe are seen sporting about on Christmas Day in this country, and the occurrence of such an event as two Sand-Martins on the wing on this date is *almost* unique ; but on the same date in 1903 a House-Martin was observed hawking for flies over a stream in this district, while on Dec. 30th of the same year a House-Martin, *possibly the same bird*, was seen near the same place.

26th to 29th.—Weather very wintry. Wind N.W. On the morning of the 27th snow lay several inches thick on the ground, and cold frosty weather continued, with the thermometer down to twenty-four degrees below freezing-point (eight degrees of frost) on the morning of 29th. Evidently the Martins had suffered severely, and were feeling the effects of the continued cold, for on the 29th only *one* bird was to be seen on the wing, and that appeared very weak, yet making a brave struggle to keep on the wing and obtain food. It would be interesting to know the fate of its companion.

30th.—Change of wind and weather ; mild S.W. wind. *Both* birds again observed, but beating up and down stream with weary flight and apparent exhaustion. How long will the unequal contest last ?

31st.—*One* bird only on the wing, but to-day it appears stronger.

1907.

Jan. 1st to 7th.—Weather variable. Sharp frosts on nights of 2nd and 3rd. Wind veered from S.W. (1st) to N.W. (7th). The solitary bird has struggled on day after day, and now (7th)

seems quite recovered from its weakness, and is once more vigorous, sweeping up and down stream with easy flight, and occasionally taking short journeys over the adjacent meadows.

9th to 13th.—Open and rather mild weather, with continuous N.W. wind. One bird only now appears to have survived, and is strong in flight. On the 11th, at noon, I thought *this* bird, too, had disappeared. After watching by the stream for some time, and not being able to see the bird either near the water or over the fields, I was about to depart somewhat disconsolate, when, as though to once more reassure me, the Martin came skimming along within a few feet of where I stood, dipped down close to the surface, snapped up an insect or two, and then disappeared again behind the farm-buildings. There is no doubt whatever in my mind that the bird has settled down to try to weather the winter, and, if insect-food holds out long enough, I have hopes it may be able to survive. But then the question arises—why has not the other Martin also managed to live, if it is only a matter of food-supply? Here is a curious and interesting instance of the “survival of the fittest,” and an enigma in evolutionary migration.

14th to 17th.—Anticyclonic weather, with mild N.W. wind each day. The bird still in evidence each day, very vigorous, and only occasionally visiting the stream. Food is evidently plentiful just now away from the water.

18th to 21st.—Anticyclone still continues; calm, mild, misty weather. Wind S.E. The Martin still on the wing, seemingly as strong and fit as ever it was in summer, and only occasionally does it hawk for insects over the stream; evidently food is obtainable in sufficient quantity elsewhere.

22nd.—Cold, wintry day; ground frozen hard. Wind N.E. Visited the stream to-day at noon, and was agreeably surprised to see the Martin still on the feed, up and down stream, and appeared quite strong and well, taking occasional flights away from the water over the fields.

23rd.—Weather as yesterday, but cutting wind from N.E. *Eleven degrees of frost last night!* Martin still courageously and persistently hawking for food close to the surface of the water. It appears to-day very feeble, and is only just able to flutter along, and does not attempt to leave the stream as yesterday.

Last night's severe cold seems to have lowered the bird's vitality almost to the lowest ebb, and it is more than likely that to-day will be its last effort to survive; the odds are very much against its being able to stand a temperature as low as that of last night.

24th to 27th.—Visited the stream each day, but no signs whatever of the Martin since 23rd; it has without doubt succumbed, but it certainly deserved a better fate.

Before finally dismissing these diary notes, there is one very puzzling point which I am unable to settle, viz. *where during the time the Sand-Martins continued to remain in the district—i.e. from November to January—before finally perishing, did they roost or conceal themselves at night?*

As is well known, these birds live in holes or burrows during their stay in this country, and sleep in the burrows at night, never, as far as I have been able to discover, in any other situation. Immediately on arrival in spring the birds repair to their nesting haunts, and use the old burrows for roosting purposes. In the district around Havant I know of no place where Sand-Martins breed within a distance of thirteen miles of the town, as the geological formation is mainly chalk, which is quite unsuited to the requirements of these birds for breeding purposes. Hence it has puzzled me very much to know in what situations and under what conditions the birds found shelter at night. Would they be likely to roost in reed-beds, or take shelter in out-buildings or stacks of hay or straw? The observations and criticisms of ornithologists on this point would be welcomed by the writer.

The following weather table serves to illustrate my remarks and criticisms bearing on the subject of migration as dependent on *wind direction*, which Mr. E. K. Robinson maintains so strenuously is a vitally important factor in bird migration (see table on next page).

In the 'Country-Side' for week ending Jan. 5th, 1907, p. 109, the Editor, Mr. E. K. Robinson, to whom I submitted some notes on the abnormally late departure of Swallows and Martins, endeavours to explain the reason for the "prolonged and untimely stay" of these birds in South Hants by saying

that "no wind from the right quarter, presumably N.E., blew with sufficient strength or persistence to reawaken the instinct of migration."

WEATHER ANALYSIS TABLE, NOVEMBER AND DECEMBER, 1906.

Date.	Direction.	Character of Weather, &c.
Nov. 19th, 20th.....	N.W.	Wind steady.
,, 21st to 24th ...	S.W. or S.E.	Gentle, but steady wind.
,, 25th to 28th ...	N.W. or W.	Breezy. Wind west on 27th.
,, 29th	S.W.	Calm.
,, 30th	N.W.	Wind steady.
Dec. 1st	N.W.	Strong wind; bright clear weather.
,, 2nd to 5th.....	N.W.	Steady wind; S.W. on 3rd.
,, 6th to 7th	N.E.	Strong on 6th; frost on 7th.
,, 8th to 11th ...	N.W.	Strong cold wind on 9th and 10th, <i>with hard frost</i> .
,, 12th	W.	Strong cutting wind.
,, 13th to 15th ...	N.W.	Steady cold breeze.
,, 16th	S.E.	Mild, with "Scotch mist."
,, 17th and 18th	N.W.	Mild and calm.
,, 19th to 23rd...	N.E.	Steady breeze; <i>hard frost</i> 21st to 23rd.
,, 24th	S.W.	Steady breeze; <i>hard frost</i> followed by thaw.
,, 25th to 28th...	N.W.	Strong wind; <i>blizzard and snow</i> on 26th, with keen frosts.
,, 29th	N.E.	Steady wind, <i>but many degrees of frost</i> .
,, 30th	S.W.	Strong wind, thaw, and rain.
,, 31st	N.W.	Steady breeze and milder.

Now, it will be seen from the above weather table that, with the exception of one day (27th), from Nov. 25th to 28th the wind blew steadily from the N.W.

This answers the point with regard to "persistence," and I should imagine a N.W. wind would be quite as favourable as one from the N.E. for migrating birds, or those, at any rate, which *desired to migrate*. A steady breeze from this direction would carry the birds across the English Channel, and land them safely on the shores of the Mediterranean in a few hours; whereas a N.E. wind would be more likely to carry them further out to sea, and thus render the journey much longer and more dangerous, because they would have to cross the Bay of Biscay, where adverse winds might carry them quite out of their course.

A short sea passage would be safer than a long one, and, besides, the advantages the birds would obtain by crossing a larger land area, by being able to stop if necessary to feed, cannot be overlooked when considering the matter whether a N.W. or N.E. wind is the more suitable for migration.

Without going through the table in detail, it will be seen that there were four days, from Nov. 25th to the end of the month, when the instinct of migration—whatever that may mean—could have been taken advantage of, but the birds did not for some inscrutable reason follow their instincts, but delayed their departure, or, as it seems to me, *were quite content to remain*, the reason for which I shall discuss later.

(To be continued.)

OBITUARY.

PROFESSOR A. NEWTON, M.A., F.R.S., &c.

ZOOLOGISTS in general, but especially ornithologists and oologists, will deplore the loss of Professor Alfred Newton, one of our most distinguished and soundest zoologists, who passed away on the 7th of June. Professor Newton, who held the Chair of Zoology and Comparative Anatomy at Cambridge since 1866, was well known and most highly esteemed, not only in Great Britain, but in every country where zoology, and more especially ornithology, is studied, and his writings, though many, were not so voluminous as they might well have been, for he never put pen to paper until he had fully studied his subject, and in consequence nothing that he wrote will pass away, but will stand as a lasting memorial of the care and hard work he bestowed on all that he undertook. Extreme accuracy was with him the corner-stone of all his work, and he would spend weeks of labour and earnest research in verifying any reference. It is scarcely necessary here to enumerate all the works he has written, but amongst these I may especially name his 'Dictionary of Birds,' written with the co-operation of Messrs. Hans Gadow, Richard Lydekker, Charles S. Ray, and Robert W. Shufeldt, a work which is indispensable to every working ornithologist; vols. i. and ii. of Yarrell's 'British Birds'; his 'Ootheca Wolleyana,' a catalogue of the celebrated collection of eggs originally formed by the late John Wolley, and completed by Professor Newton himself, which, though commenced as long ago as 1866, was only completed shortly before his death; and his various papers on the Great Auk or Gare-fowl.

As one of the founders—probably the chief of the small band of ornithologists who founded, nearly fifty years ago, the British Ornithologists' Union—Professor Newton and his coadjutors gave an impetus to the study of ornithology which has had most gratifying and lasting results.

A severe though a very fair critic, and a hard hitter when he deemed it necessary to administer salutary correction, Professor Newton was a firm friend, most courteous, genial, and pleasant in manner in personal intercourse, and especially kind and helpful towards young ornithologists; therefore he was greatly loved and revered by all who came in personal contact with him. It was a constant custom with him to be

at home on Sunday evenings to young students of zoology, and all who have taken part in these pleasant reunions will know how helpful he invariably was to any young man who was working at any branch of zoology. In this, as in his influence on the study of ornithology, he will be sorely missed, and there is no one who can take his place.

Although permanently lame, owing to an accident in early childhood, he did good work as an outdoor naturalist, and travelled considerably, visiting Norway, Lapland, Spitzbergen, Iceland, the West Indies, and North America, making excellent use, as his writings show, of his opportunities to study the habits of birds in their native haunts.

A keen oologist, Professor Newton amassed a very good collection of eggs, almost entirely of Palæarctic species, and of some, chiefly northern, a very large series—and this valuable collection he has bequeathed to the Cambridge University Museum. His chief hobby was, however, his library of ornithological and zoological books, and whenever a rare ornithological work was in the market he would use every endeavour to secure it, usually with success. Hence this library, which he has also bequeathed to the Cambridge University, is extremely rich, and contains several of the rarest and most valuable ornithological and oological works.

Though very broad-minded, Professor Newton was somewhat conservative, and to the last he was strongly averse to the extreme subdivision of species, often on the very slightest grounds, now so prevalent amongst some ornithologists of the present day, as also to the use (or, we may almost say, abuse) of trinomial appellations, he being essentially a binomialist.

Professor Newton was the fifth son of William Newton, of Elvedon Hall, Suffolk, formerly M.P. for Ipswich, and was born at Geneva on the 11th of June, 1829. Educated at first by a private tutor, he graduated at Cambridge in 1853, and was appointed Travelling Fellow of Magdalene College in 1854, and then visited the countries above enumerated. He was subsequently a vice-president of the Royal, Linnean, and Zoological Societies, and was awarded the gold medal of the Linnean Society, and in 1900 one of the Royal Society's medals.

I first made Professor Newton's acquaintance in 1858, on my return to England from Finland, when he came to my father's town house to examine the collection I had made during my sojourn in Sweden and Finland, and since then he has been the most constant and truest friend it has been my good fortune to possess.

H. E. DRESSER.

NOTES AND QUERIES.

MAMMALIA.

Badger near Cheltenham.—A fairly large specimen of a Badger was recently killed at Brimpsfield, near here, in a wooded "combe" at an elevation of about nine hundred feet above the sea-level. These animals are stated to be not uncommon in the neighbourhood.—**CHAMPION LE CHAMBERLAIN** (Fairhaven, Cheltenham).

AVES.

Occurrence of the Sardinian Warbler in Sussex.—On June 4th a Sardinian Warbler (*Sylvia melanocephala*) was brought to me in the flesh for identification by Mr. G. Bristow, Jun., naturalist, of Silchester Road, St. Leonards-on-Sea. It had been killed the day before in the neighbourhood of Hastings, and proved on dissection to be a male. Being unable to be present at the British Ornithologists' Club Dinner in London on June 19th, the bird was kindly exhibited on my behalf by Dr. C. B. Ticehurst, M.B.O.U., who informs me that this is the first really authenticated occurrence of this species in the British Islands, though Mr. W. D'Urban saw what was apparently a bird of the same species in his garden at Exmouth on April 16th, 1890. This is referred to in Mr. Howard Saunders's 'Manual,' where he writes:—"There is not the least improbability of this bird occurring in the British Islands, since it is common in the South of France and in the Peninsula." It 'probably got swept north in the tide of spring migration. I hope to record this occurrence of the Sardinian Warbler also in part iii. of vol. i. of the Journal ('Hastings and East Sussex Naturalist') of the Hastings and St. Leonards Natural History Society.—**THOMAS PARKIN** (Fairseat, High Wickham, Hastings).

The Scaup-Duck (*Fuligula marila*) in Cheshire.—On the 12th May last I saw an adult male of this Sea-Duck on Redesmere, Cheshire. It proved to be very tame, and I was able to approach to within some twenty yards of it. The head, neck, and breast were black, glossed with green; mantle finely vermiculated with pale grey and white, which in the distance looked white, and was met with the white of the

belly overlapping the wing; tail, rump, and flight-feathers black or dark brown; the bill, which was slightly upturned, was bluish slate-colour; eye bright yellow. In the morning, when I first saw the bird, it was searching for food, and dived frequently in the shallow water of the narrow end of the mere; in the evening, when last seen, it had retired to the centre of the mere, where it was resting near a few Tufted Ducks, from which it was easily distinguished by its light back.—FRANK S. GRAVES (Ballamoar, Alderley Edge).

The Shoveler (*Spatula clypeata*) in Cheshire.—I noticed two birds of this species on Redesmere, Cheshire, on the 19th April last. They were adult male and female, and, judging by their behaviour, had paired, but when I visited the mere next day they had gone. These are the first Shovelers I have seen on this mere, or, indeed, in Cheshire. The poise of these Ducks on the water is remarkable; the fore part of the bird is much sunk, as though weighed down by the large bill, and the tail stands clear of the water.—FRANK S. GRAVES (Ballamoar, Alderley Edge).

Non-breeding Birds.—Quite from the beginning of May a pair of Little Terns (*Sterna minuta*) have remained on Breydon, instead of joining the assemblies of their species at Blakeney and at Wells. I have seen them every time I have gone on Breydon, and on reference to the note-book of the watcher Jary found dates, recording their constant presence, between my own. The female appears to be not nearly so strong on the wing as its mate, which is most attentive to it, continually fishing for it, and dropping tiny Herrings on the mud near it, or into its mouth, and what appeared to me to be Gobies and Shrimps as well; these latter were fished out of the tinier "drains," the former being snatched out of the deeper "channels." At the present time the usual summer muster of Gulls is to be seen on the mud-flats; there are numerous examples of Black-backed Gulls, from the fine adult males to the last year's "greys," including oddly blotched birds of the third and fourth years. They are living fairly well now on the flotsam that drifts upstream on the flood from the shrimpers' nets, and on Shore-Crabs scuttling about among the rank *Zostera*. The immature Common and Black-headed Gulls are very persistent in waiting upon the Herons, who, when satiated with Flounders and Eels, will continue to strike and capture prey, to be thrown away at length upon the flats. As late as May 26th some Knots in the perfect "red" of spring were loitering on Breydon. If these were on their way to their nesting quarters the time they were enabled to devote to household matters must be exceedingly short.—ARTHUR H. PATTERSON (Ibis House, Great Yarmouth).

PISCES.

Tailless Sole.—On June 19th I had brought to me by a fish-hawker a small Sole (*Solea vulgaris*), which at no period of its existence had owned a caudal appendage, the posterior extremity of the fish being perfectly rounded, and the dorsal and anal fins quite continuous, without a break. The fish measured 7 in. in extreme length, with a width of $3\frac{1}{2}$ in., inclusive of the fins. As will be seen by the photograph, the



TAILLESS SOLE (*Solea vulgaris*).

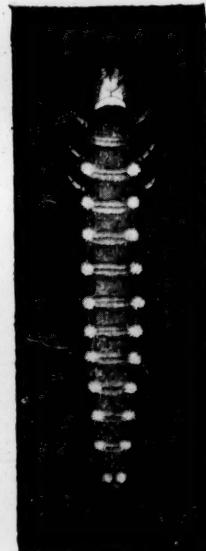
fish is quite oval in shape. There was a slight damage to the fin-membrane at the extreme end, done probably in the trawl-net. I met with a specimen of this fish (*vide* 'Notes of an East Coast Naturalist,' p. 225) in 1890, somewhat similarly malformed, but in that instance the two fins turned in, making a V-shaped inlet.—ARTHUR H. PATTERSON (Ibis House, Great Yarmouth).

MOLLUSCA.

Carnivorous Propensities of a Slug.—On my visiting (June 11th) some traps I had set for Mice, I found a Bank-Vole caught, and feeding on it was a large Slug (*Limax flavus*). It had already devoured a considerable portion of the Vole, having made a round hole about the size of a shilling. This was a surprise to me, as I had no idea Slugs were carnivorous, and had always regarded them as purely vegetarians.—GORDON DALGLIESH (Brook, Witley, Surrey).

INSECTA.

A Remarkable Luminous Insect from Brazil.—The female beetles of the group *Phengodini*—a group nearly related to our ordinary Glow-worms—are exceptionally interesting, not only on account of their remarkable luminosity, but also from the fact that they retain in adult life all the external features of the larva. Whether the specimen figured here is really a mature female or only a well-grown larva cannot at present be determined. This specimen, by the kindness of Mr. J. Kempthorne, who brought it alive from Manaos, in Brazil, has been recently added to the National Collection, where hitherto the group was represented only by male specimens. It is very nearly $1\frac{1}{2}$ in. long, sparsely covered with hairs, especially at the sides, the general colour pale yellow, slightly brownish on the dorsal segments, with the head and last segment reddish brown; the eyes, antennæ, and mandibles black. The head and the front part of the first thoracic ring glow on all sides with a red light, like that of a live coal, the light appearing to be concentrated in two centres, one in the head, the other in the thorax. Each succeeding segment, except the last, has a pair of lights, which, in marked contrast with those of the head and prothorax, are of a distinctly green colour, resembling in miniature the green signal-lights used on railways. The possession of lights of two different colours appears to be confined to South American species of the group; at least, I have not been able to find any reference to the red light in the head in any of the accounts given of North American species. One of the South American forms has been described as having a red light at each end of the body, and a row of green lights along each side. The males are slightly luminous, the luminosity being confined to one or more of the ventral plates of the abdomen.—C. J. GAHAN (Brit. Mus.).



NOTICES OF NEW BOOKS.

The Sense of Touch in Mammals and Birds, with special reference to the Papillary Ridges. By WALTER KIDD, M.D., F.Z.S. Adam & Charles Black.

THIS is a very useful book ; if it does not propose or support a theory, or is somewhat inconclusive in result, it still becomes, by its illustrations and descriptions, a text-book on the subject. The impressions of the palmar and plantar surfaces of many mammals, especially Primates, will afford quite a new study to some zoologists ; while the literature on the subject, given in an appendix, is a most welcome addition. It is in the literature relating to the study of evolution that these books find their place ; this one, having no novel theory, nor leading to any startling conclusion, may possibly and probably be little known beyond the ranks of a few students. The general reader requires a sensational summary. How many, to whom the name of Darwin is a household word, and 'Natural Selection' and the 'Descent of Man' accepted axioms, have really studied the facts on which those conceptions are founded ?

According to Mr. Kidd, the Orang has a hand which approaches nearly to the shape of the human hand. The Gorilla has a hand and foot of more powerful appearance than any other Anthropoid Ape, the hand resembling a clumsy human hand, while the foot is more powerful than that of the Orang. The hand of the Chimpanzee is most human of all in general form, but less complex as to patterns than the Gorilla or Orang, but more so than the Gibbon. The result of Mr. Kidd's method of enquiry points out that the Anthropoid Apes are distinguished from all the Primates below them by marked simplicity of palmar and plantar pattern, and by higher development of apical pads in the Orang and Gorilla, the former change being common to the whole group, the latter to only two out of the four.

Mr. Kidd seems to place a very high value—perhaps too high

—on the use of the hand to man in the basal element of his progress in civilization. Referring to the periods known as Stone, Iron, and Bronze Ages, he writes:—"It is easy to understand that in such a development of mechanical appliances as these titles indicate the sense of touch has played an extremely important part." We should consider it was more the evolution of human intelligence which produced the evolution in handicraft.

There are one hundred and seventy-four illustrations and diagrams.

A Hunter's Wanderings in Africa; being a Narrative of Nine Years spent amongst the Game of the Far Interior of South Africa. By F. C. SELOUS. Macmillan & Co., Ltd.

THIS is a new and fifth edition of a book with a deserved reputation and an evergreen interest. To the real sportsman of big-game the volume requires no recommendation, but it is a question whether mammalogists and other zoologists are always aware of the valuable observations it contains—observations made in the field, and recorded at the time. This is particularly the case as regards the Lion. "All the Dutch hunters in the interior, as well as many Europeans who pretend to higher scientific attainments, say there are at least three distinct species of Lions in South Africa, while some assert that there are four or even five." These distinctions are based on the length and colour of the mane, the general colour of the coat, the spots on the feet, and the comparative size of the animals. But Mr. Selous, with a healthy appreciation of variable characters, recognizes but one species, and most zoologists will entirely agree with him. Chapter xiii. is an excellent summary of the author's experience of the South African representative. Another idea that may be laid to rest refers to the South African Buffalo. All representations of these animals "charging with their heads lowered are purely imaginary, as they never do so, but, on the contrary, invariably hold their noses straight out, and lay their horns back over their shoulders. They lower their heads just as they strike."

The work is well illustrated, and collectors who may have acquired head or horn trophies from South Africa will have little trouble in identifying the species to which they belong.

The volume also possesses a sad interest to those who have wandered across the veld or through the bush of South Africa. It is a tale of recent time, but as regards the game, of a long ago and a vanishing fauna. When Mr. Selous first visited the country there was no Johannesburg, but there was a hunter's paradise ; Bulawayo had not supplanted the kraal of Lobengula, and Elephants could be found in places which will see them no more. Perhaps the time has come when the colonizing march in the southern part of the African continent will at least pause, and, apart from local gold and diamonds, one of the poorest countries in the world may be able again to exhibit its wealth in wild mammals.

The Insect Hunter's Companion. By the Rev. JOSEPH GREENE, M.A. Fifth edition, revised and extended by A. B. FARN. West, Newman & Co.

GREENE's 'Insect Hunter's Companion' is one of the lesser classics to the British entomologist, and this revised edition in a very cheap form will doubtless procure it still more readers. Its contents are so generally well known that nothing more need be said than that it is indispensable to every young entomologist, while older ones can still look through its pages with pleasure. We have been more than once asked, when abroad, for a short concise guide to aid in the collection of insects. In the future this pocket volume will be the answer to that enquiry.

